

# Equity Prices, Monetary Policy, And Economic Activities In Emerging Market Economies: The Case Of South Africa

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## ABSTRACT

*This paper investigates the possible influence equity price shocks have on economic activities and inflation in emerging market economies such as South Africa. Moreover, the paper discusses the role monetary policy action should play in preventing or reducing the disruptive effects of equity market volatility in emerging markets. It uses the structural vector error correction (SVEC) model to identify the different shocks and obtain the impulse response functions in a case study of South Africa. The paper finds that positive shocks to equity prices negatively affect expected inflation in the first two quarters before the effect becomes positive. This finding indicates that initially high stock market valuations raise the expectation of high capital and labour productivity by investors. Later on, the possibility of high stock prices increasing economic activity creates an expectation of high inflation rates in the future. From this finding, the paper concludes that the monetary authority in emerging markets in general and South Africa in particular should include equity prices in its reaction function.*

**Keywords:** Equity Prices and Economic Activities in Emerging Market Economies; Monetary Policy and Economic Activities in Emerging Market Economies; Structural Vector Error Correction (SVEC) Model

## I. INTRODUCTION

The 2007 worldwide equity market volatility and the financial and economic instability that followed have provided the prospect of reviving the debate on the possible influence equity prices have on economic activities as well as the role monetary policy action should play in preventing or reducing the disruptive effects of equity market volatility on the economy. The unresolved debate on whether monetary authority should react to asset price inflation in general as well as to goods and services price inflation in formulating monetary policy decisions again warrants scrutiny in the light of the current financial crisis.<sup>1</sup> Few would deny the fact that the 2007 global financial crisis was the result of the bursting of the asset price bubble, which has put an end to the ‘irrational exuberance’ of most developed equity markets.

A number of studies have attempted to understand the interconnection between monetary policy, equity prices and economic activities, in the context of developed economies, in order to assess the ability of the monetary authority to reduce the disruptive effects of stock price volatility (see for example Bernanke and Gertler, 2001, and Cecchetti, Genberg and Wadhmani, 2003). However, few such attempts have been made in relation to emerging and developing economies. Many may argue that emerging and developing equity markets are to a great extent influenced by developed equity markets. Thus, the argument goes, emerging equity market volatility is unrelated to its economic fundamentals and is often associated with financial instability in developed economies (Morck, Yeung and Yu, 2000). While it might seem that monetary policy, like any other domestic economic policy in emerging markets, will not succeed in influencing equity markets, nonetheless, the increasing participation of local investors and the surge of domestic markets in a number of emerging markets have contributed to the growth of their equity

<sup>1</sup> See Bernanke and Gertler (2001) and Cecchetti, Genberg and Wadhmani (2003) for contrary views on whether monetary authority should react to equity price inflation.

markets. These realities indicate the extent of the contribution of internal conditions and policies to the growth of emerging equity markets and convey the important message that the degree of interconnection between equity prices, internal policies (such as monetary policies) and economic activities in emerging market economies is instead a matter for empirical analysis.

The main aim of this paper is therefore to assess the dynamic responses of inflation, economic activities and short-term interest rates to equity price shocks in South Africa as an emerging market economy. The findings of this paper mainly document the extent to which equity prices influence inflation in South Africa and the degree to which the South African Reserve Bank (SARB) should monitor and respond to excessive increases in equity prices. The paper will identify the different shocks within the structural vector autoregressive (SVEC) model.

The remainder of the paper is organised as follows. In section 2, the paper presents a literature review on the relationship between inflation, equity prices and monetary policy. Section 3 presents the SVEC model. Section 4 introduces the data and discusses the empirical findings. Section 5 presents the test of robustness of the results. Section 6 concludes the paper.

## **II. LITERATURE REVIEW**

Theoretically, there are various channels through which asset price movements influence economic activities. Asset prices affect the economy through the so-called ‘consumption-wealth channel’, according to which households holding assets (equity or real assets) feel wealthier as asset prices rise. The increase in their financial wealth results in higher consumption, stimulating aggregate demand and output. According to Altissimo et al. (2005), the transmission of asset price changes to consumption is largely dependent on how permanent asset price changes are expected to be. The effect on consumption of asset price changes that are expected to be transitory will be less. A second channel through which asset price movements influence economic activities is known as ‘the balance sheet channel’. The balance sheet channel stresses the potential impact that the quality of a company’s balance sheet may have on investment spending decisions. A rise in asset prices improves the balance sheet position of companies through the revaluation of shareholder equity and other assets. This in turn increases the ability of companies to provide collateral for external finance, and enhances their access to external funds for investment. In the case of declining equity prices, the risk that lenders face increases and this reduces their propensity to extend credit. This reduced inclination of lenders to extend credit results in a decrease in investment demand and a deterioration of aggregate demand and the overall economic condition (Foerster and Sapp, 2005).

The current international financial turmoil, which has given rise to a reduction in the availability of credit, mainly in the United States (US) and some European countries, should provide an insight into the effectiveness of the consumption-wealth as well as the balance sheet channels of the stock price transmission mechanism. The third channel, known as ‘Tobin’s  $q$  or cost-of-capital channel’, shows how a change in asset prices implies a change in the cost of raising equity capital to finance corporate investment. Tobin (1969) introduced the ‘ $q$  theory’ to describe how movement in stock prices can affect investment. Tobin’s ‘ $q$ ’ or valuation ratio represents a ratio of the stock price to the replacement cost of investment. If the valuation ratio is greater than one, the market price of companies is high relative to the replacement cost of capital for investment. Thus, companies can issue stocks at a high price to expand their real investment. With the increase in investment spending, aggregate demand and output will increase. For Tobin (1969) equity finance is a very important channel through which stock price movements affect investment and output.

The last channel through which asset price movements affect economic activities is known as the ‘confidence channel’. Equity market volatility may have indirect effects on economic activities through its impact on consumer and business confidence. For example, a rise in equity prices signals good economic prospects, which alter market participants’ assessment of economic risks and affect investment and consumption decisions. Arnold, Van Els and De Haan (2002) found that share prices lead confidence indicators in a number of European countries and the US. Nevertheless, the authors caution that this outcome may simply reflect wealth and the cost of capital effects instead of a causal relationship between equity price and confidence indicators.

On understanding whether asset prices affect the level of inflation, Tatom (2002) found that there is a negative long-run equilibrium relationship between inflation and equity prices. The author found that the causality evidence indicates that this relationship between asset prices and inflation is uni-directional in that increases in the equity price lead to lower inflation. Fama (1981) contended that the negative relationship between stock returns and inflation observed during the post-1953 period in the US is puzzling given the accepted wisdom that common stock should be a hedge against inflation. Moreover, the author showed that this negative relationship is the consequence of proxy effect. Stocks returns are determined by forecasts of more relevant real variables, and the negative relationship between stock returns and inflation is induced by negative relations between inflation and real activity.

Chami, Cosimano, and Fullerkamp (1999) assert that inflation has an impact on asset prices. The authors maintain that contractionary monetary policy to curb inflation decreases the real value firm's assets and causes a decrease in equity prices. Akram and Eitrheim (2008) argue that stabilising inflation and output may not be sufficient to induce stable growth in asset prices and the credit market, as stability is necessary for a stable financial sector and real economy. This is because asset prices are often more or less disconnected from their fundamentals.

The question as to whether the formulation of monetary policy action should take equity prices into account depends on the impact equity prices have on inflation and economic activities. There are two competing schools of thought in the literature regarding the response of monetary policy to asset price changes or bubbles. The first school of thought, mainly associated with Bernanke and Gertler (2001), recommends that monetary policy should respond only to observed changes in asset prices to the extent that they signal changes to inflation or any other indicator that monetary policy targets. This conclusion is challenged by Cecchetti, Genberg and Wadhmani (2003), who represent the second school of thought. The authors argue that raising interest rates modestly as asset prices rise above what are estimated to be warranted levels can reduce the effects of asset price bubbles on output and inflation, thus enhancing financial and macroeconomic stability.

A number of empirical studies have been conducted, mainly in developed economies, to test whether it is relevant to central banks to include asset prices in the objectives of monetary policy. For example, Cassola and Morana (2004), in their study on the role of monetary policy on the stock market in the Euro area, find that permanent monetary policy surprises have a strong, yet temporary, impact on the stock market, but a permanent impact on inflation. Thus, the authors conclude that monetary policy focus on the stock market could easily become incompatible with the price stability objective.

Gruen et al.(2005) suggests that sufficient information about the bubble should be available to policymakers before any intervention is made. The author argues that it may be optimal to 'lean against' some bubbles but not others and judgments should be made about the process driving the bubble and its likely sensitivity to monetary policy. Akram and Eitrheim (2008) argue that monetary policy can become more effective in reaching its macroeconomic objectives, including financial stability, by stabilising asset prices and/or the credit market, in addition to inflation and output. The authors find that an increase in interest rates by the monetary authority to react to excess growth in equity prices and credit demand enhances inflation and output stability.

It can be noted that a large number of studies that focus on the link between equity prices, monetary policy and economic activities have been conducted in the context of developed countries. A few have attempted to focus on a particular aspect of this topic in the context of emerging countries. For example, Funke (2004) suggests that emerging market economies should rather focus on the development of an appropriate regulatory environment, tax system, such as capital gain, and financial infrastructure to reduce the risk of future bubbles. Viegli (2006) uses a New Keynesian model calibrated to the South African data to show that one cannot evaluate the relationship between monetary policy and asset prices without introducing into the analysis the fundamental role played by fiscal policy dynamics. The author shows that asset price volatility might be directly linked to the fiscal-monetary policy framework chosen.

There are very few studies devoted to the relationship between equity prices, inflation and monetary policy in the context of developing and emerging market countries, and this state of affairs should be attributed to the insignificant role stock markets play in a number of these countries. Nonetheless, the South African financial system is classified among the best in the world: it has an organised equity market, and is the first in Africa in terms of

market capitalisation. For example, while the market capitalisation of all the countries on the African continent was only about US\$569 billion in mid-2005, the market capitalisation of the Johannesburg Security Exchange in South Africa grew to over US\$886 billion during the fourth quarter of 2007. The market capitalisation of the Egyptian Stock Exchange, the second largest in Africa, and the Nigerian Stock Exchange, the third largest, was US\$150 billion and US\$2 billion, respectively, at the end of 2007 (Yartey, 2008).

South Africa is currently a full member of BRICS (Brazil, Russia, India, China and South Africa) grouping, which grouping includes very influential and prominent emerging market economies. BRICS countries stave off the 2007 global financial recession to the credit of their sound monetary and fiscal policy, coupled with reliable financial system. These commonalities should have justified their unification and the prospect of their hegemony.

South Africa, like a number of developed and emerging market economies, has adopted an inflation-targeting framework as the anchor for monetary policy since 2000. This inflation-targeting framework is set in a forward-looking model that takes into account the time lag effect of monetary policy. Furthermore, a reliable system for forecasting inflation is an important precondition for an inflation-targeting framework. Thus, it is vital for the SARB to have a good insight into the determinants of inflation in South Africa.

With regard to the South African Consumer Price Index (CPI), the only asset price included in the CPI basket is the price of housing. Housing costs had a weighting of 22.1 percent in the CPI basket before the adoption of the new CPI basket in January 2009. In the new CPI basket, the weighting of housing cost is even higher – averaging 23.2 percent (Statistics South Africa, 2009). Equity prices are not included in the CPI basket (be it the old or new CPI basket) in South Africa. This means that changes in equity prices do not directly reflect in the rate of inflation and, thus, are unable to send a signal for monetary policy action. Nonetheless, this does not exclude the indirect impact equity prices might have on the rate of inflation, and the monetary policy authority thus needs to monitor its development.

### III. METHODOLOGY

This paper mainly makes use of the SVEC model to characterise the dynamic responses of equity prices to economic activity, inflation and monetary policy shocks through the impulse response functions in South Africa as an emerging market economy. The modelling of the dynamic behaviour of economic variables, through impulse response function (IRF) analysis, is extensively used in a vector autoregressive (VAR) framework. Nonetheless, the VAR model is ‘atheoretical’ and therefore there is little economic content in the results provided by the IRF analysis. Like structural vector autoregressive (SVAR) models, the SVEC models provide a framework where the results that are obtained from the IRF have economic meaning. Nonetheless, contrary to SVAR models, SVEC models are suitable for identifying economic shocks when a cointegration relationship exists between variables in the model.

The SVEC analysis starts from a reduced-form standard VEC model.

$$\Delta y_t = \alpha\beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + \dots + \Gamma_{p-1} \Delta y_{t-p+1} + \mu_t \quad (1)$$

Where  $y_t$  is a  $K \times 1$  vector of time series,  $\Gamma_1 \dots \Gamma_{p-1}$  are  $K \times K$  coefficient matrices. The reduced form disturbance  $\mu_t$  is an  $K \times 1$  unobservable zero mean white noise process with the covariance matrix  $\Sigma\mu$ .  $\alpha$ ,  $\beta$  and  $\Gamma$  are parameter matrices representing the loading parameter, the cointegrating vectors and short-run parameters, respectively. From Johansen’s (1995) version of Granger’s representation theorem, it follows that the VEC model has the following moving average representation.

$$y_t = \Xi \sum_{i=1}^t \mu_i + \Xi^*(L)\mu_t + y_0^* \quad (2)$$

where  $\Xi = \beta_{\perp}(\alpha'_{\perp}(I_K - \sum_{i=1}^{p-1} \Gamma_i)\beta_{\perp})^{-1}\alpha'_{\perp}$  and represents the long-run effects of forecast error impulse response.  $\alpha_{\perp}$  and  $\beta_{\perp}$  represent the orthogonal complement of  $\alpha$  and  $\beta$ , respectively.  $I_K$  is the identity matrix.  $\Xi^*(L) = \sum_{j=0}^{\infty} \Xi_j^* L^j$  is an infinite-order polynomial in the lag operator with coefficient matrices  $\Xi_j^*$  that tend to zero as  $j \rightarrow \infty$ . It is important to note that  $\Xi_j^*$  contains transitory effects and has a rank  $K - r$  if the cointegrating rank of the system is  $r$ . The term  $y_0^*$  contains all initial values of the vector time series. The forecast error impulse responses based on  $\Xi$  and  $\Xi^*(L)$  are without economic meaning, as they are obtained from the reduced-form disturbance (see Equation 2). Structural shocks need to be identified for a meaningful impulse response analysis. The relationship between the reduced-form disturbances and the underlying structural shocks is written as follows:

$$\mu_t = A\varepsilon_t \quad (3)$$

where  $K \times 1$  vector  $\varepsilon_t$  contains the unobservable structural shocks and has a covariance of  $\Sigma\varepsilon$ . Substituting Equation (3) in Equation (2) yields the orthogonalised short-run impulse responses obtained as  $\Xi^*(L)A$  and the long-run effects of  $\varepsilon_t$  shocks expressed as  $\Xi A$ .

It is important to note that if the system has  $r$  cointegrating relations,  $k = (K - r)$  shocks will have permanent effects, while at most  $r$  shocks will have transitory effects. To exactly identify permanent shocks  $k(k-1)/2$  restrictions (elements of the matrix  $\Xi A$  set to zero) are needed in addition to the  $k$  independent restrictions. Similarly,  $r(r-1)/2$  additional contemporaneous restrictions are needed to identify the transitory shocks. There are  $K(K-1)/2$  restrictions in total to exactly identify matrix  $A$ .

#### IV. DATA AND EMPIRICAL ANALYSIS

In this paper we use quarterly seasonally adjusted data for South Africa from January 1980Q1 to November 2008Q3. The end period corresponds to the time before the full effect of the 2007-2008 global financial crisis was felt in the South African economy. This indicates that this paper assesses the dynamic effects of stock prices shocks on expected inflation and economic activities in South Africa before the effect of the global financial crisis. The specification of the VEC model uses the Treasury bill rate (TB) as a variable to represent the short-term interest rate. It is important to note that central banks operate at the short end of the market and thus short-term rates follow the same trend as the monetary policy interest rate instruments in a number of countries, including South Africa (Roley and Sellon, 1995; Aziakpono et al, 2007). The natural logarithm of gross domestic product (GDP) is used as an important indicator of economic activities in South Africa. The paper also makes use of the expected inflation ( $Ep_t^1$ ) time series constructed from the adaptive expectation hypothesis<sup>2</sup> using actual inflation time series. It is important to note that the results of surveys on household inflation expectations in South Africa indicate that households formulate their inflation expectations differently (Rossouw et al., 2009). Inflation expectations by households vary according to the gender and location of people surveyed. This is a clear indication that different assumptions need to be considered when inflation expectations in South Africa are formulated. The choice of the adaptive expectation

<sup>2</sup> The adaptive expectation formula for the unobserved expected inflation  $Ep_t^1$  can be expressed as  $Ep_t^1 = \lambda P_t + (1 - \lambda)Ep_{t-1}^1$ ;  $0 \leq \lambda \leq 1$ .  $P_t$  represents the actual inflation obtained as the first difference of the natural logarithm of CPI (all metropolitan areas). The time series for  $Ep_t^1$  is simulated with  $\lambda = 0.8$ , which provides the lowest root mean square error when compared with  $P_t$ .

hypothesis for the construction of expected inflation adopted by this paper is supported by the reality that economic agents adjust their expectation from past mistakes. Expected inflation, rather than actual inflation, is used in the paper to reflect the fact that monetary policy is forward-looking in South Africa, and that the SARB reacts to expected inflation rather than to actual inflation in the conduct of monetary policy. The natural logarithm of the Johannesburg all-share equity indices (LNJSE) is used to represent equity prices. The VEC model in this paper includes the natural logarithm of the South African Rand–US Dollar exchange rate (EXCH) to account for the importance of the exchange rate in determining stock prices in emerging market economies (Abdalla and Murinde, 1997). All the series are sourced from the Quantec database. Before the empirical analysis of the SVEC model is undertaken we first investigate the integration properties of the four time series. We apply the the Saikkonen and Lutkepohl (2002) unit root test that accounts for structural breaks. Two dummy variables are used to account for structural breaks. The first dummy variable takes the value of zero before March 1995 and unit afterward. In fact, in an effort to stimulate economic growth, the South African government re-abolished the financial rand system and lifted all controls on non-resident investors in March 1995, allowing the liberalisation of the Johannesburg Securities Exchange and the South African Bond Exchange. This move resulted in a massive increase in stock turnover and foreign investment in local financial assets (Tswamuno, 2007). The second dummy variable accounts for the change in monetary policy regime with the adoption of the inflation-targeting framework in South Africa from February 2000. Table 1 presents the results of the unit root test for all the series. The results show that all the series are integrated of order one.

Table 1: Unit root test with structural break

Variables	Test statistics		Critical values		
	Level	First difference	1%	5%	10%
$GDP_t$	0.3973	-12.835	-3.48	-2.88	-2.56
$Ep_t^1$	-0.6754	-4.8135	-3.48	-2.88	-2.56
$TB_t$	-2.9158	-2.9158	-3.48	-2.88	-2.56
$EXCH_t$	-0.4712	-4.4214	-3.48	-2.88	-2.56
$LNJSE_t$	-1.1992	-5.3679	-3.48	-2.88	-2.56

The results reported in Table 1 show that all series are integrated at the order of one.

To test the number of cointegration relations, we set up an initial VAR and include a constant and the two dummy variables as deterministic terms. Nonetheless, the likelihood ratio (LR) test of deletion of the dummy variable representing the change in monetary policy regime in South Africa in the VAR provides a  $\chi^2(5) = 2.9825$  and probability of 0.703. This indicates that the null hypothesis of the deletion of this dummy variable is not rejected at the 5% level. Thus, the only dummy variable considered in the VAR process is the March 1995 liberalisation of the JSE. The cointegration test is conducted according to the procedure suggested by Johansen, Mosconi and Nielsen (2000). Johansen, Mosconi and Nielsen show that if there is a structural break in the data-generating process and if the break can be captured by adding dummy variables to the deterministic part of the system, the inclusion of such variables in the model will lead to a change in the asymptotic distributions for the cointegrating rank. Thus, to determine the cointegrating rank the lag length of the VAR process,  $p = 3$ , was selected using the Hannan-Quinn (HQ) information criteria. The two dummy variables were included as exogenous variables. The LM-test, not reported here, indicated that there is no serial correlation in the VAR residual when the lag length of 3 is selected. The results of the trace and Max-eigenvalue tests of cointegration, reported in Tables 2 and 3, respectively, indicate the presence of two cointegrating relations or ranks ( $r = 2$ ). The vector we use in the cointegration analysis includes:

$$y_t = (Ep_t^1, TB_t, LNJSE_t, EXCH_t, GDP_t) \quad (4)$$



Table 2: Trace test for Cointegration

Null Hypothesis	Trace Statistics	Critical value (5%)	Probability
$r = 0$	97.5430*	47.8561	0.0000
$r = 1$	45.1380*	29.7970	0.0004
$r = 2$	14.2401	15.4947	0.0766
$r = 3$	0.1590	3.8414	0.6900

Trace test indicates 2 cointegration equations at the 5% level. \* denotes rejection of the null hypothesis at the 5% level

Table 3: Maximum Eigenvalue test for cointegration

Null Hypothesis	Trace Statistics	Critical value (5%)	Probability
$r = 0$	52.4052*	47.8561	0.0000
$r = 1$	30.8978*	21.1316	0.0016
$r = 2$	14.0811	14.2646	0.0534
$r = 3$	0.1590	3.8414	0.6900

Maximum-Eigenvalue test indicates 2 cointegrating equations at the 5% level. \* denotes rejection at the 5% level

The identified long-run relationship can be interpreted as the Fisher effect relation and long-run relationship between the real equity market index and real output.

While the results of the VEC model inform the long-run relations and short-run adjustment of variables, the dynamics of the variables are better represented by the IRF obtained from a structural analysis. This is in line with the aim of this paper, which intends to shed light on the effect of surprise changes in monetary policy on equity prices.

With regard to the SVEC model analysis, we know from section 3 that we need a total of  $K(K-1)/2=10$  linearly independent restrictions coming from economic theory for the exact identification of structural shocks. As there are two cointegrating relations in the VAR system, this indicates that two of the shocks will have transitory effects in the system. With reference to the functioning of the South African economy as well as the assumption of economic theories, these shocks are identified as monetary policy (short-term interest rate) shocks and exchange rate shocks. Identifying restrictions are obtained by restraining the long-run multiplier matrix of the shocks to interest rate and exchange rates. Accordingly, interest rate shocks and exchange rate shocks have no long-run impact on the variables included in  $y_t$ .

As to why the effects of interest rate shocks are transitory, economic theory in general and practical experience in South Africa in particular confirm the long-run neutrality of monetary policy (short-term interest rates) as well as the short-run monetary disequilibrium theory (Bond, 1984; Du Plessis et al., 2008). The transitory effect of exchange rate shocks is in line with the automatic stabilisation theory of exchange rate.

The advantage of using these specific restrictions is that they provide a theoretical justification for the operation of internal and external policies under the different regime changes in South Africa. Additional restrictions are applied to the short-run impulse response matrix  $\Xi^*(L)A$  such as a non-contemporaneous effect of monetary policy shocks on economic activities, as well the non-contemporaneous effect of equity price shocks on expected inflation. Given the order of the variables as in Equation (4), these identifying restrictions correspond to the following structure on the short-run impact matrix  $\Xi^*(L)A$  and long-run impact matrix  $\Xi(L)A$ .

$$\Xi^* A = \begin{pmatrix} * & * & * & * & * \\ * & * & * & * & * \\ * & * & * & * & * \\ 0 & * & * & * & * \\ 0 & 0 & 0 & * & * \end{pmatrix} \quad \Xi A = \begin{pmatrix} * & 0 & * & 0 & * \\ * & 0 & * & 0 & * \\ * & 0 & * & 0 & * \\ * & 0 & * & 0 & * \\ * & 0 & * & 0 & * \end{pmatrix} \quad (5)$$

Note that unrestricted elements are indicated by asterisks. Maximum likelihood is used to estimate parameters in the matrices  $\Xi(L)A$  and  $\Xi^*(L)A$ .

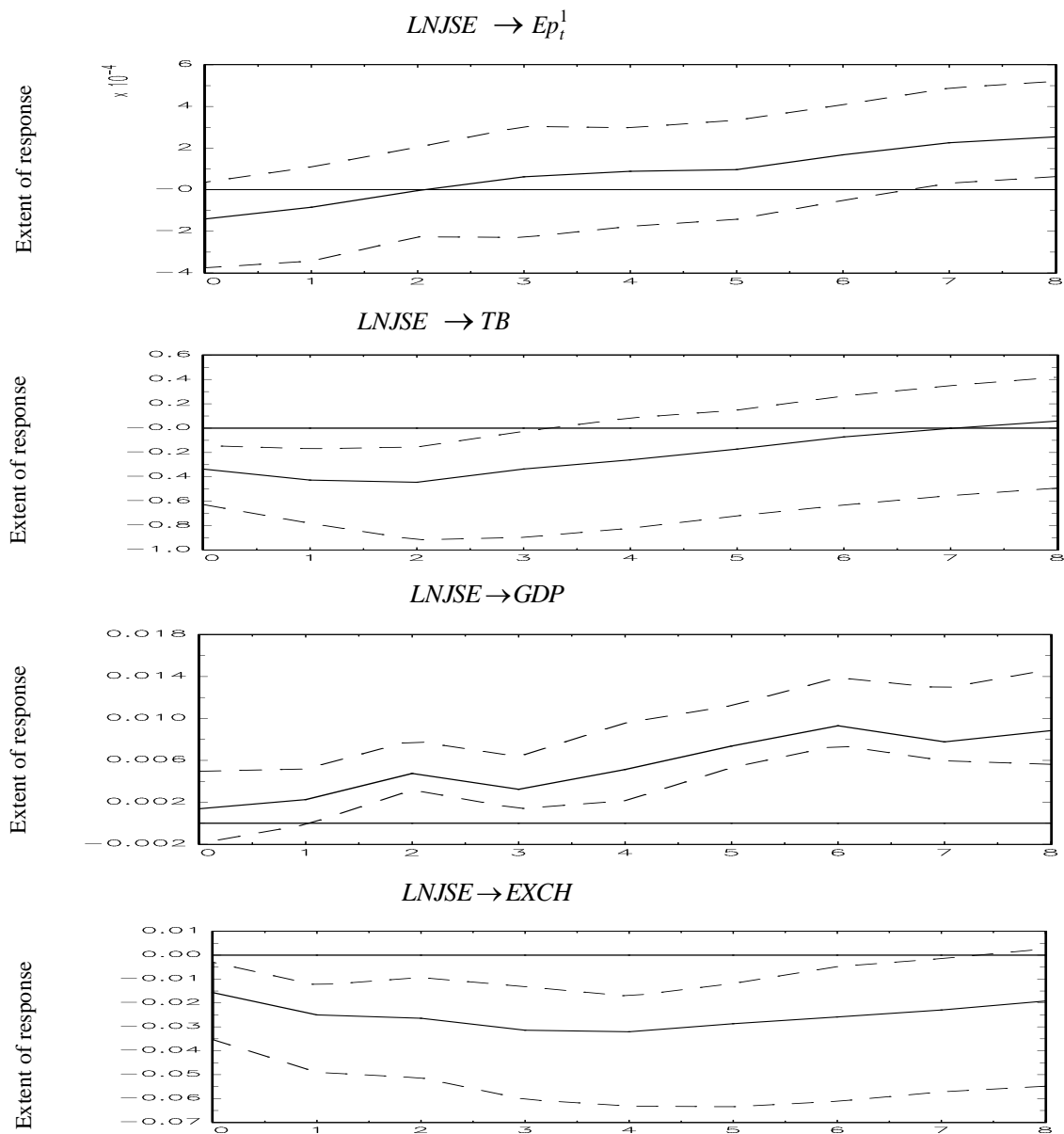


Figure 1: Responses of  $Ep_t^1$ , TB, GDP and EXCH to LNJSE shocks



Because the focus of the paper is to assess the dynamic responses of the different variables in  $y_t$  to shocks to equity prices, use is made of the estimates from the long-run and short-run impact matrix to obtain the impulse responses of the variables included in  $y_t$  in respect of identified structural shocks.

Figure 1 depicts the impulse response functions of  $Ep_t^1$ , GDP, EXCH and TB to one-standard deviation LNJSE shocks for a period of 8 quarters. It is important to note that a long horizon is needed to assess the effect of stock prices shocks on economic activities (Boudoukh and Richardson, 1993). Figure 1 indicates that the response of expected inflation to equity price shocks,  $LNJSE \rightarrow Ep_t^1$ , is negative for the first two quarters before it becomes positive and statistically significant from the seventh quarter, as indicated by the 95% Hall bootstrap confidence interval. The negative reaction of expected inflation to equity price shocks should indicate that high stock market valuations signal that investors expect rapid capital and/or labour productivity growth, and thus create an expectation that inflation will decrease in the near future. This occurs in the first two quarters. As time goes by, high stock market valuation and the increase in stock prices that follows will raise expected inflation. This happens because of the positive effect of stock prices on GDP.

It is important to note that when GDP increases, economic agents expect a rise in aggregate demand, and, thus, an increase in future or expected inflation. Moreover, given that GDP responds positively to LNJSE shocks (see  $LNJSE \rightarrow GDP$ ) and that expected inflation reacts positively to GDP shocks (see Figure 2), there seems to be support for the proxy hypothesis in the long-run in that the observed positive response of expected inflation to stock price shocks is derived from the positive response of expected inflation to GDP shocks.

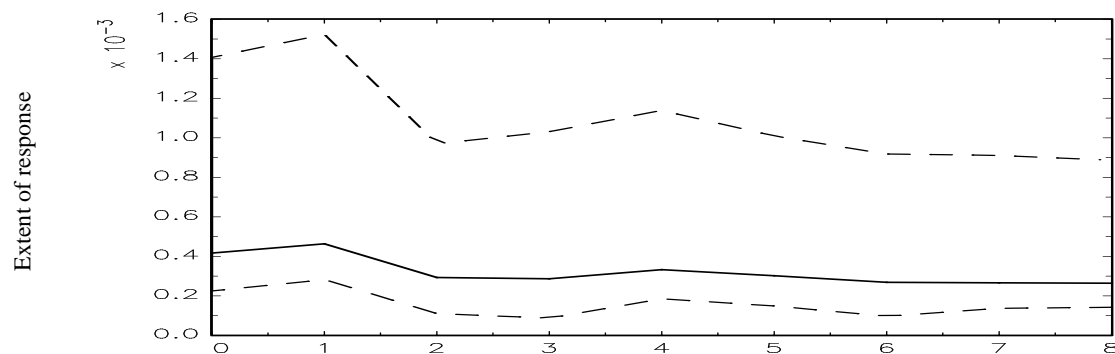


Figure 2: Response of  $Ep_t^1$  to GDP shocks

The finding of this paper raises an important concern about whether monetary policy in South Africa should react if signs of a stock market bubble emerge in the equity market. As long as equity prices increase the level of GDP, and this phenomenon creates the possibility of a rise in aggregate demand, monetary authority in South Africa should include equity prices in its reaction function. Nonetheless, the weak response of expected inflation to shocks to equity prices,<sup>3</sup> as indicated in Figure 1, provides an indication that monetary authority in South Africa should attach a small weight to equity prices in its reaction function to avoid the possibility of limiting economic growth in South Africa. Although inflation targeting is the anchor of monetary policy in South Africa, the SARB needs to strike the right balance between controlling inflation and encouraging economic growth in the conduct of monetary policy.

There are other very important findings from the results reported in Figure 1 related to the responses of the rand-dollar exchange rate and short-term interest rate to shocks to equity prices. The results in Figure 1 show that positive shocks to equity prices leads to an appreciation of the rand-dollar exchange rate. The rationale of this

<sup>3</sup> A one-standard deviation shock to equity prices leads to an almost 0.0002 standard deviation increase in expected inflation in the seventh quarter.

finding is that the good performance of the equity market leads to capital inflow of a portfolio investment type, and, thus, appreciation of the South African currency. This reality indicates the importance of foreign participation in the South African equity market. On the importance of foreign participation in the South African equity market, it is important to note that foreign trading volumes on the Johannesburg Securities Exchange (JSE), the sole licensed stock exchange in South Africa, have increased sevenfold from 1996 to 2007 (JSE, 2008).

With regard to the response of the short-term interest rate to shocks to equity prices, Figure 1 shows that the interest rate responds negatively to shocks to equity prices up to the seventh quarter, before the response becomes positive. It is important to note that the response of expected inflation to shocks to equity prices becomes positive and statistically significant around the seventh quarter. Thus, the positive reaction of interest rate to shocks to equity prices coincides with the positive reaction of expected inflation to the same shocks. This indicates that the monetary authority in South Africa reacts actively to the inflation outlook by changing the short-term interest rate.

## **V. ROBUSTNESS OF THE RESULTS**

To assess the robustness of the results of the IRFs, we re-estimated the VECM model using five lags, as suggested by other criteria for lag selection (the Schwarz information criterion). In addition, we changed the order of the shocks in the long-run impact matrix  $\Xi(L)A$ , whereby transitory shocks preceded permanent shocks. The results obtained were not different from those reported in Figure 1 and Figure 2. This indicates that our results are robust.

## **VI. CONCLUSION**

This paper mainly assessed the responses of inflation, gross domestic inflation (economic activity), exchange rates and short-term interest rates to equity price shocks in order to determine whether the SARB should include equity prices in its reaction function. To identify the different shocks and obtain the impulse response functions, the paper made use of the SVEC model. The results of the impulse response functions show that the response of expected inflation to equity prices shocks is negative for the first two quarters before it becomes positive and statistically significant in the seventh quarter. This finding indicates that positive shocks to equity prices signal initially that investors expect rapid capital and/or labour productivity growth. Nonetheless, as time goes by, high equity prices positively affect GDP, and, thus, inflation is expected to rise given the possibility of an increase in aggregate demand due to high economic activities. Although the paper recommends that the monetary authority should include equity prices in its reaction function, given their ultimate positive effect on expected inflation, the weight allocated to equity prices in the reaction function should be minimal given the small positive reaction of expected inflation to equity price shocks.

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**NOTES**